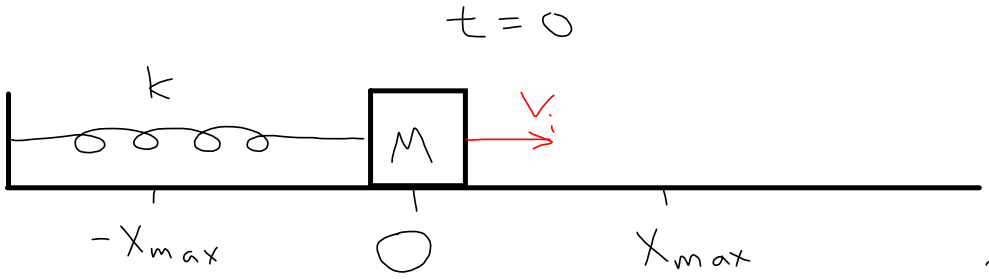
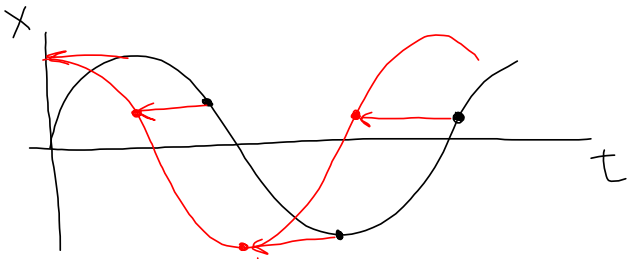


Time for 1 full oscillation (Period, T) = $\frac{2\pi}{\sqrt{\frac{k}{m}}}$

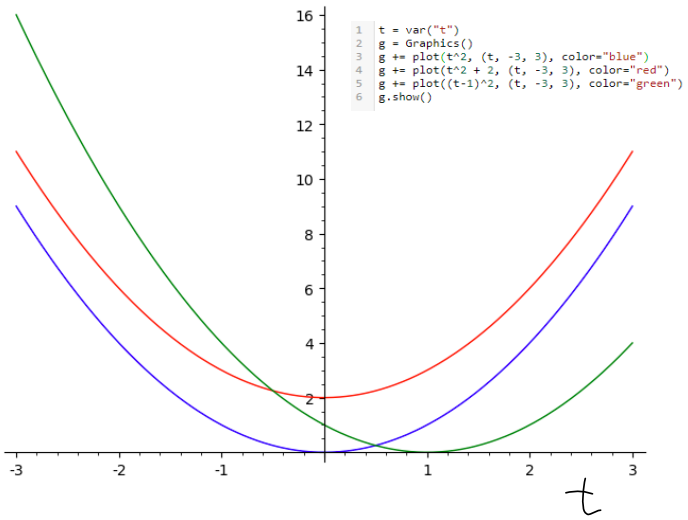
$X(t) = X_{max} \sin\left(\sqrt{\frac{k}{m}}\, t\right)$

frequency, $f = \frac{1}{T}$

angular frequency, $\omega = 2\pi f$



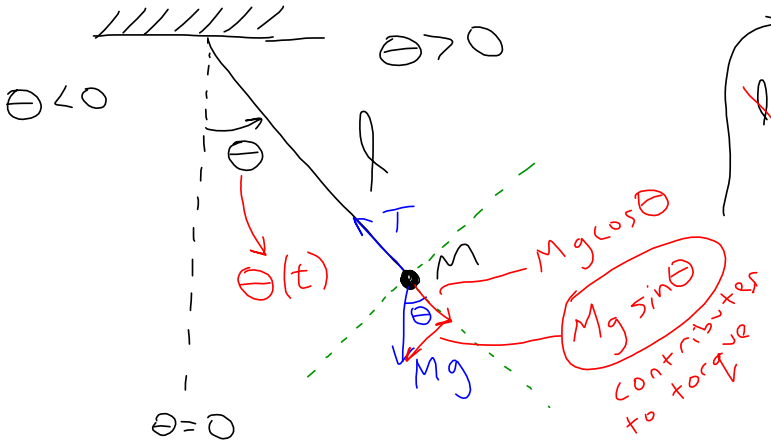
$\rightarrow X(0) = X_{max}$, $V_i = 0$



To shift a graph to the right by 5:

$t \rightarrow (t) \rightarrow (t-5)$

Another SHO - Pendulum



$$\tau = I\alpha$$

$$-lMg\sin\theta = -(Ml^2)\frac{d^2\theta}{dt^2}$$

for small angles:

$\sin\theta \approx \theta$ (in radians)

$$g\theta = -l\frac{d^2\theta}{dt^2}$$

compare to:

$$kx = -m\frac{d^2x}{dt^2}$$

$$\theta(t) = \theta_{max}\sin\left(\sqrt{\frac{g}{l}}\,t + \phi\right)$$

A spring-mass SHO is described by:

$x(t) = (0.25\ m)*\sin((0.4\ rad/s)*t + (0.1\ rad))$

1. If M = 3 kg, what is the spring constant? $k = 0.48\ N/m$

2. What is the instantaneous velocity at t = 1 s? $V(1s) = 0.088\ m/s$

3. How many oscillations per second does the system do? $f = 0.063\ Hz$

* We will skip sections 15.6 and 15.7

Complete the following table:

t (s)	$x(t) = (2\text{m}) \begin{matrix}\sin\\ \cos\end{matrix}\left(\left(1\frac{\text{rad}}{\text{s}}\right)t\right)$	$y(t) = (2\text{m}) \begin{matrix}\cos\\ \sin\end{matrix}\left(\left(1\frac{\text{rad}}{\text{s}}\right)t\right)$
0		
0.5		
1.0		
⋮		
6		

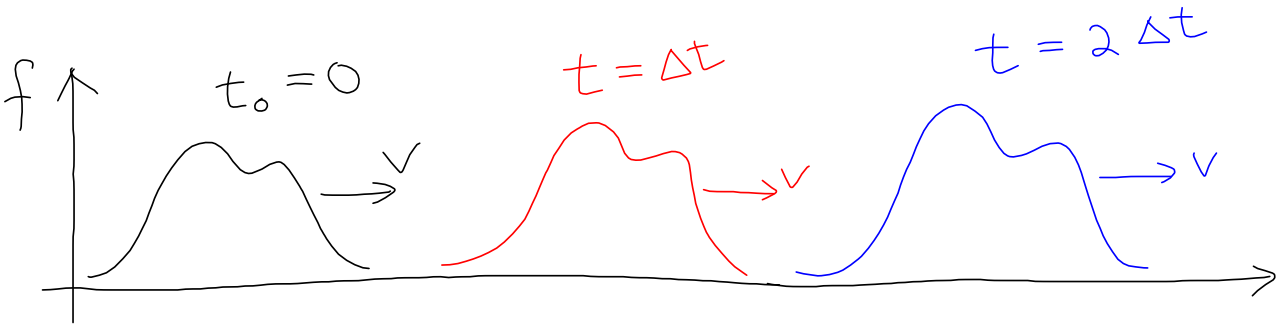
plot the points (x, y) for $0 < t < 6$ s.

What happens if you change one of the:

- Amplitudes?
- Frequencies?
- Phase?

Chapter 16 - Waves

Formal definition of a wave: Something with fixed shape that moves at a constant velocity. E.g. propagation of a disturbance.



$f(x)$ $f(x-\Delta x)$ $f(x-2\Delta x)$

In general, for a wave traveling with velocity V, and shape $f(x)$ at $t=0$,

$$f(x,t) = f(x-Vt)$$